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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/635,651	08/07/2003	Taro Ikeda	033082R167	8788

441 7590 04/03/2008

SMITH, GAMBRELL & RUSSELL
1130 CONNECTICUT AVENUE, N.W., SUITE 1130
WASHINGTON, DC 20036

EXAMINER	
CULBERT, ROBERTS P	
ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
04/03/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/635,651	IKEDA, TARO	
	Examiner	Art Unit	
	Roberts Culbert	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 December 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5,6,8-11,14 and 16-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5,6,8-11,14 and 16-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 12/14/07 have been fully considered.

Applicant argues that since according to Qian et al., high-frequency electric power is supplied continuously to the mount (the pedestal 107) even after switching off supply of high-frequency electric power to the conducting member (the electrode 220), Qian et al. fails to teach that the second high-frequency electric power source is stopped supplying high-frequency electric power to the mount after the first high-frequency electric power source has started the supply of the high-frequency electric power to the antenna means so that high-frequency electric power is supplied only to the antenna means. The argument is not persuasive to overcome the rejection of the applied Prior Art, because Nowak teaches that it is alternatively known to strike plasma using RF power supplied to the mount as an electrode, while preferably grounding the top electrode. (col. 4, lines 32-40)

Applicant has argued that the arrangement relied upon in Nowak cannot be said to disclose or suggest a grounded conducting member that is "arranged within the plasma processing system so as to be permanently and at all times free from direct electrical connection with a high-frequency electric power source. However, Foster teaches a grounded conducting member free from direct electrical connection. Further, since Nowak teaches the top electrode may be preferably grounded, one of ordinary skill in the art would have found it obvious at the time of invention to provide permanent connection to ground for the conducting member for the alternative when the mount is used to strike the plasma.

Applicant has argued that in addition, new dependent claim 30, similar to former claim 28 describes a preferred limited overlap between the two HF sources not disclosed or suggested in the references relied upon in rejections. The argument is not persuasive. Nowak teaches a simultaneous or limited overlap transition for the maintainance of the plasma (col. 6, lines28-35). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention was made to modify the process of Raaijmakers et al. modified by Nowak et al. or Forster et al. so as to shut down the capacitively coupled

plasma to the mount while starting the inductive power as suggested by Nowak, or after as suggested by Qian et al. and Nowak et al. because in such a way an effective inductively coupled plasma without a capacitively coupled portion can be maintained for inductively coupled plasma processing after striking plasma using capacitive coupling.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5, 6, 8, 14-16, and 20-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,460,689 to Raaijmakers et al, in view of U.S. Patent 6,220,201 to Nowak et al, or EP 0 685 873 A1 to Forster et al, and in further view of U.S. Patent 6,447,636 to Qian et al.

Raaijmakers et al. shows the invention substantially as claimed including a plasma processing method for performing plasma processing by using a plasma processing system comprising a chamber for housing a substrate-to-be-processed; a belljar 12 disposed on the chamber in communication with the chamber and having a side wall and a top wall of an insulator; a conducting mount 18 disposed in the chamber, for the substrate to be processed to be mounted on; an antenna means 28 disposed on the outside of the side wall of the belljar, for generating induced electromagnetic fields in the belljar; a first high frequency electric power source 40 for supplying high frequency electric power to the antenna means; gas supply means (34,36a,36b) for supplying a plasma generating gas which is dissociated by the induced electromagnetic fields generated by the antenna means to be plasma, and a processing gas for the plasma processing; and a second high frequency power source 42 for applying high frequency power to the mount, high frequency electric power being supplied from the second high frequency electric power source to the mount to generate electric fields vertical to the substrate to be processed between the mount and the conducting member and generate plasmas.

Raaijmakers et al. does not expressly disclose a flat conducting member disposed above the top wall, opposed to the mount, being permanently grounded and free from direct electrical connection with a high frequency electric power source, and high frequency electric power supplied to the mount and then supplied to the antenna. Nowak et al. discloses a flat conducting member 24 disposed above the top wall for capacitively coupling plasma to the chamber (see fig. 1 and its description), where the conducting member can be permanently or at all times grounded during this process (see col. 4-lines 62-64) and can be in a state free of direct electrical connection with a high-frequency electric power source. Alternatively, Forster et al. discloses initiating capacitive coupling using a permanently grounded conducting mount 180 opposed to a substrate and in a state free of direct electrical connection with a high frequency power source (see fig. 3 and its description). Therefore, in view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. so as to have a flat conducting member disposed above the top wall as disclosed by Nowak et al. and/or Forster et al. because this allows for the formation of a high quality, more uniform and efficient capacitively coupled plasma. Furthermore and with respect to high frequency electric power supplied to the mount and then supplied to the antenna, Nowak et al. discloses igniting the plasma by supplying high frequency electric power to the mount and then high frequency electric power to the antenna (see col. 4-lines 27-31). Therefore, in view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. so as to perform the ignition process as disclosed by Nowak et al. because this allows for a suitable ignition of high quality plasma for processing.

Raaijmakers et al., Nowak et al., and Forster et al. do not expressly disclose a Faraday shield disposed between the antenna means and the belljar. Qian et al. discloses a Faraday shield 210 between the antenna and the chamber (see fig. 1 and its description), and a substrate heater (see col. 4-lines 29-37). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. modified by Nowak et al. or Forster et al. to have a Faraday shield between the antenna and the chamber and to heat the substrate while

processing because in such a way capacitive coupling from the antenna can be prevented from entering the chamber and the process can be more effectively controlled by controlling the substrate temperature.

Furthermore, regarding claims 14 and 20, Qian et al. discloses shutting down the capacitively coupled plasma power after the inductively coupled plasma is initiated. In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. modified by Nowak et al. or Forster et al. so as to shut down the capacitively coupled plasma as suggested by Qian et al. because in such a way an effective inductively coupled plasma with a small capacitively coupled portion can be maintained for inductively coupled plasma processing.

Further, regarding claims 5, 6 and 28-30, Raaijmakers et al, Nowak et al, and Forster et al. teach the method of the invention substantially as claimed, but do not expressly teach that the second high frequency power source stops supplying power to the mount after the first high frequency power source has started supplying power to the antenna means or that the first high frequency power source to the antenna is started while the second high frequency power source to the mount is stopped. However, Qian et al. discloses shutting down the capacitively coupled plasma power after the inductively coupled plasma is initiated. Nowak teaches that it is alternatively known to strike a plasma using RF power supplied to the mount as an electrode while preferably grounding the top electrode. (col. 4, lines 32-40) Nowak teaches a simultaneous or limited overlap transition for the maintainance of the plasma (col. 6, lines28-35). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. modified by Nowak et al. or Forster et al. so as to shut down the capacitively coupled plasma to the mount while, or after starting the inductive power as suggested by Qian et al. and Nowak et al. because in such a way an effective inductively coupled plasma without a capacitively coupled portion can be maintained for inductively coupled plasma processing after striking a plasma using capacitive coupling.

Claims 9 and. 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,460,689 to Raaijmakers et al, in view of U.S. Patent 6,220,201 to Nowak et al, or EP 0 685 873 A1 to Forster et al, and in further view of U.S. Patent 6,447,636 to Qian et al. as applied to claims 5, 6, 8, 14-16, and 20-30 above, and further in view of U.S. Patent 6,652,711 to Brcka.

Raaijmakers et al., Nowak et al., Forster et al., and Qian et al., are applied as above but do not expressly disclose using the plasma processing for removing natural oxide films from the substrate. Brcka discloses using a plasma system for removing natural oxide from the substrate (see col. l-lines 15-19). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. modified by Nowak et al., or Forster et al. and Qian et al. so as to perform a process to remove native oxide from a substrate because as disclosed by Brcka, a plasma apparatus is commonly used for such a purpose.

Claims 10-11 and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,460,689 to Raaijmakers et al, in view of U.S. Patent 6,220,201 to Nowak et al, or EP 0 685 873 A1 to Forster et al, and further in view of U.S. Patent 6,447,636 to Qian et al, and further in view of U.S. Patent 6,652,711 to Brcka, as applied to claims 9 and 17 above, and further in view of U.S. Patent 6,776,170 to Liu et al.

Raaijmakers et al., Nowak et al., Forster et al., Qian et al., and Brcka are applied as above but do not expressly disclose using argon and hydrogen to remove the native oxide. Liu et al. discloses removing native oxide using hydrogen and argon gas (see col. 3-line 66 to col. 4-line 14). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Raaijmakers et al. modified by Nowak et al., Forster et al., Qian et al., and Brcka so as to remove the native oxide using hydrogen and argon gasses because Liu et al. teaches that such gasses are suitable for the intended purpose of removing native oxide from a substrate.

Concerning claims 11 and 19, note that in Raaijmakers et al. the first high-frequency electric power source is connected to an upper end portion of the antenna means.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571)272-1433. The examiner can normally be reached on Monday-Friday (8:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Roberts Culbert/
Primary Examiner, Art Unit 1792